Institute for Materials Science

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Institute for Materials Science Lecture Series

Stojan Jovanovic
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Trondheim, Norway

Temporal Evolution of Grid Cell Learning

Thursday, July 28, 2016
2:00 - 3:00 pm
MSL Auditorium (TA-03 - Bldg 1698 - Room A103)

Abstract : Grid cells are neurons in the brains of most mammals (such as mice, rats, bats and monkeys) that become active when the animal visits certain locations in its environment. In neuroscience, a cells is said to be active if it fires off an action potential, or spike, which is a transient electrical signal it uses to communicate with other neurons.

A particularly interesting thing about grid cells is that, when the spatial locations in which a specific cell "spiked" are plotted on top of the environment the animal is moving in, one obtains a very regular, hexagonal pattern. In other words, an individual grid cells is only active when the animals is standing on top of a node of an (almost) perfect hexagonal lattice. Different grid cells have latices with different spacings and orientations, but is thought that the combined information from many grid cells firing (or not firing) simultaneously as the animal moves perform the function of "path integration" in the brain. In a nutshell, they provide the animal with a coordinate system of space.

The discovery of grid cells earned the people responsible a Nobel prize in Medicine in 2014. So far, however, no one has thoroughly investigated how the hexagonal patterns of grid cells form as the animal investigates a novel environment.

I will be talking about a project that is aiming to do just that. By using data analysis techniques inspired by the fields of computer vision and condensed matter physics, we will
attempt to elucidate how grid cells patterns evolve in an animal, learning about its surroundings. In particular, we will address the question : in the grid cell's hexagonal lattice, does orientational order "set in" before positional (translational) order does?

Bio: After receiving his bachelor's and master's degrees in statistics, probability and applied mathematics from the University of Belgrade, Serbia, Stojan Jovanovic studied computational neuroscience as a PhD student at the Bernstein Center in Freiburg, Germany and the Royal Institute of Technology in Stockholm, Sweden. In his PhD project, Stojan studied the interplay between graph topology and correlations of higher order in networks of point processes, frequently used models of spiking neural networks. Currently, he is employed as a researcher at the Kavli Institute for Systems Neuroscience in Trondheim, Norway, where he studies statistical properties of grid cells firing patterns.

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Hosted by Alexander Balatsky * Director of the Institute for Materials Science

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